Atlas of Genetics and Cytogenetics in Oncology and Haematology

OPEN ACCESS JOURNAL AT INIST-CNRS

Gene Section
Mini Review

RPS27 (ribosomal protein S27)

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Published in Atlas Database: August 2011

Online updated version : http://AtlasGeneticsOncology.org/Genes/RPS27ID45550ch1q21.html
DOI: 10.4267/2042/46937

Identity

Other names: MPS-1, MPS1, S27

HGNC (Hugo): RPS27

Location: 1q21.3

Local order: Human RPS27 is found on chromosome 1: 153963235 - 153964626 bp from pter. Information about the local order for RPS27 can be found at ensembl.org. Four transcripts have been identified, but only the first will be discussed below.

DNA/RNA

Description

The RPS27 gene is comprised of 1.39 kb and consists of 4 exons. This gene is a member of the Human CCDS set: CCDS1059.

Transcription

The transcript is 350 base pairs long.

Pseudogene

Multiple RPS27 pseudogenes are dispersed throughout the genome. The RPS27L pseudogene, located at 15q22.2, is known to encode a protein that shares 96% of its amino acid sequence with RPS27 (Balasubramanian et al., 2009).

Protein

Description

RPS27 is a 9461 Da protein composed of 84 amino acids. The protein contains a C4 zinc finger domain, similar to steroid and thyroid hormones, which enables DNA binding. RPS27 is found in both the cytoplasm and the nucleus.

Expression

Ubiquitous expression. Expressed at high levels in actively dividing cells and in cancers of ectodermal origin, as well as in melanoma (Fernandez-Pol et al., 1993). When overexpressed, it is secreted into serum (Lee et al., 2004).

Function

1. Component of the 40S ribosomal subunit in the cytoplasm: ribosomes carry out translation of proteins. The eukaryotic ribosome is made up of a small 40S and a large 60S subunit. Together these subunits are comprised of 4 different rRNA species and almost 80 different RP's (ribosomal proteins). As a component of the 40S subunit, RPS27 is found near RPS18 and covalently bound to translation initiation factor eIF3.
2. A mediator of cellular proliferation and survival: expression is induced by a variety of growth factors and other signaling molecules, including TGF-beta and cAMP; RPS27 can bind to cAMP response elements of DNA (Fernandez-Pol et al., 1993).
3. Oncogenesis (see below).

Homology

Member of the ribosomal protein S27e family.

Mutations

Note

Single nucleotide polymorphisms have been identified, but have not been linked to disease.

Implicated in

Various carcinomas and melanoma

Note

RPS27 overexpression has been reported in many cancers including prostate cancer (Fernandez-Pol et al., 1997), colorectal cancer (Ganger et al., 1997), liver cancer (Ganger et al., 2001), breast cancer (Atsuta et al., 2002), head and neck squamous cell cancer (HNSCC) (Stack et al., 1999; Stack et al., 2004; Lee et al., 2004), gastric cancer (Wang, et al., 2006), as well as, melanoma (Santa Cruz et al., 1997).

Since high serum levels of RPS27 have been found in cancer patients, especially in head and neck squamous cell carcinoma (HNSCC), the protein can be used as a tumor marker (Fernandez-Pol et al., 1996; Lee et al., 2004; Stack et al. 2004).

Prognosis

It was reported that RPS27 levels correlate with tumor stage in patients with gastric cancer, thus high levels serve as a poor prognostic indicator (Wang et al., 2006).

Oncogenesis

The mechanism behind RPS27 overexpression is currently under investigation. One explanation recently offered arises from the relationship between RPS27, MDM2 and p53: RPS27 is a p53 repressible protein (He and Sun, 2007; Li et al., 2007). A 2011 study found that it competes with p53 for a central acidic binding domain on MDM2. Once bound, MDM2 is stimulated to ubiquinate and degrade the RPS27 or p53, whichever it is bound to. When RPS27 levels are elevated, it can out-compete p53 for MDM2 binding and subsequent degradation, thus stabilizing p53 levels. This would be an appropriate cellular response to genotoxic stress. The same study also found that mutant p53 cannot suppress RPS27, only the wild-type can. Since mutated p53 is found in almost 50% of all human cancers, RPS27 overexpression logically follows. Furthermore, stabilization of mutant p53 levels associated with RPS27 abundance could provide malignant cells with a growth advantage (Xiong et al., 2011).

RPS27 knockdown was found to enhance spontaneous apoptosis of tumor cells via caspase-3 activation (Wang et al., 2006; Yang et al., 2011).

HNSCC: some have questioned if RPS27 overexpression is the cause or result of cancer. A 2010 study overexpressed RPS27 in a line of HNSCC cells to study the impact on tumor behavior. They found that RPS27 overexpression resulted in reduced cancer cell growth, proliferation rate and angiogenesis. RPS27 overexpression was also found to reduce the mRNA of Paxillin, a focal adhesion protein up regulated in HNSCC and many other cancer cells. RPS27 induced Paxillin repression offers a possible explanation for the decreased HNSCC growth (Dai et al., 2010).

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This article should be referenced as such:

Pierson T, Stack BCJr. RPS27 (ribosomal protein S27). Atlas Genet Cytogenet Oncol Haematol. 2012; 16(2):103-105.